

## Objectives

The primary goal of the GASIS project is the development of a national database of geological, engineering, production and ultimate recovery data for U.S. oil and gas reservoirs. GASIS data will be used as input to DOE reservoir-based technology assessment models and as a stand-alone database for gas resource characterization and assessment. GASIS will be made available on CD-ROM with query and retrieval software, and will have applications in the areas of exploration, development, planning, resource characterization, and technology and market assessment.

GASIS will be the first national public domain reservoir property and production database, and will combine selected GRI/DOE Gas Atlas data, data from Dwight's Energydata databases, new data from reservoir studies, GRI data, and new processed data elements into a single database with approximately 20,000 records. The data matrix will contain about 180 data fields for each reservoir.

A large-scale geological data collection and analysis effort is a major component of the project. This field

and reservoir study effort will greatly improve the quality and coverage of reservoir and fluid property data and will provide the first true "reservoir definition" for many fields in the Mid-Continent and elsewhere. The geological studies will also provide DOE with an improved database for analysis of low permeability reservoirs in several basins.

The GASIS project also includes the development of an electronic directory of information on other government and private sector gas supply-related databases and information sources.

Energy and Environmental Analysis (EEA) is the lead contractor for developing GASIS. EEA is managing database design, software development, special data analysis projects, and Source Directory development. The primary subcontractor is Dwight's Energydata. Dwight's field and reservoir group in Oklahoma City is conducting field and reservoir geological studies and related data collection activities.

## Scope Of Gasis Database

Figure 1 shows the two major components of the Gas Information System. The primary component is the Reservoir Data System, which will consist of approximately 20,000 reservoir records containing reservoir and fluid properties, play classification, and summary production data. Each record will contain approximately 180 data fields. The other component of GASIS is the Source Directory, which will document over 250 oil and gas supply-related databases and information cen-

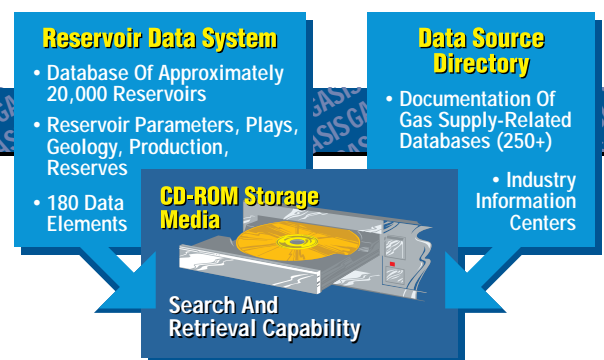


Figure 1. The Components Of GASIS

ters currently available to industry. Both components of GASIS will be assembled on a single CD-ROM, along with Windows-based search and retrieval software.

Figure 2 shows the types of data planned for the Reservoir Data System. Included are field and reservoir identification, location, producing status, play classification, reservoir and fluid properties, geologic information, production data, and estimated remaining reserves. Also included are reservoir area and average well spacing, completion level ultimate recovery data, a geological type well (from the reservoir studies),

drilling and completion data, and gas composition.

The Source Directory will document public domain and commercial databases that contain geological, engineering, production, well completion, and related data of interest to oil and gas producers and the research community. It will also document major oil and gas information centers, sample repositories, and technology transfer centers.

## Content Of The Reservoir Data System

The following paragraphs describe in more detail the information that will be included in the GASIS Reservoir Data System. The data types

shown in Figure 2 are represented in the database by approximately 150 data elements. An additional 30 data elements report information sources for key reservoir parameters.

### Field & Reservoir Identification & Status

- Field and Reservoir Names
- Field and Reservoir Codes
- Reservoir Classification (oil and gas)
- Location Information
- Field and Reservoir Discovery Years
- Producing Status
- Number of Producing Gas Completions
- Tight Gas, Coal, and Shale Identification

### Geological Parameters

- Gas Atlas Play
- Lithology
- Age
- Depositional System
- Trap Type
- Heterogeneity

### Reservoir Area And Well Spacing

- Published and Calculated Gas Productive Area
- Calculated Average Gas Well Spacing

### Reservoir Parameters

- Depth
- Net Pay (and range)
- Porosity (and range)
- Permeability (and range)
- Temperature
- Water Saturation
- Initial Pressure
- Drive Mechanism

### Gas & Fluid Properties

- Gas Gravity
- Water Resistivity

### Drilling, Stimulation, And Completion Data

- Summary Information on Drilling and Completion Practices
- Identification of Stimulated Reservoirs
- Identification of Horizontally Drilled Reservoirs

### Geological Type Well Data

- Identification and Producing Interval

### Median Recovery Well Data

- Identification and Location

### Completion Level Recovery Statistics

- Mean, Median, Minimum, and Maximum Ultimate Recovery per Completion

Each record will include field and reservoir names, codes, reservoir type, location, and status information. Reservoir type will include the official state designation (oil or gas) as well as the gas reservoir classifications used in the Gas Atlas project (nonassociated, gas cap, or dissolved gas). Tight gas, coalbed methane, and shale gas reservoirs will be identified.

Geological data elements include the Gas Atlas play name and code, general and specific lithology, geologic age code, trap type, and depositional system. A classification of the type and level of horizontal and vertical reservoir heterogeneity is also included.

Both published and calculated reservoir area and well spacing data will be included. Gas productive area and calculated average gas well spacing will be determined through analysis of Dwight's gas completion database (for all areas except the Appalachian Basin).

A full range of reservoir engineering and fluid parameters is included. Data

elements include reservoir depth, net pay, porosity, permeability, temperature, saturations, water resistivity, and initial pressure. Current reservoir pressure will also be included where data are available.

Some basic drilling, completion, and stimulation data are also included. Currently, most of the information in this category is being collected only for studied

### Summary Gas Production Data

- Cumulative Oil and Gas Production
- One Year of Annual Production

### Reserves And Gas-In-Place

- Estimated Remaining Gas Reserves and Ultimate Recovery
- Published Gas-in-Place

### Gas Composition

- C<sub>1</sub> through C<sub>6</sub>, Nitrogen, Carbon Dioxide, and H<sub>2</sub>S

Figure 2. Summary Of Information Included In The GASIS Reservoir Data System

reservoirs. An exception is the identification of horizontally drilled reservoirs, which covers the entire database and is based upon information compiled by Dwight's. In the future, electronic well history data can be used to identify artificially stimulated reservoirs and to characterize basic drilling, completion, and stimulation practices for all GASIS reservoirs.

GASIS will include documentation of a "geological type well" from each of the reservoir studies. It is the well which is considered to have a representative reservoir section. Well identification, location, and producing interval are included in the database. In addition, a bitmap image of each type well with the producing interval identified will be provided.

The database will include statistical information on completion level ultimate recovery. Using Dwight's DOGR completion level database, an ultimate recovery estimate will be made for each gas completion. The minimum, maximum, mean, and median completion level ultimate recoveries will be reported for each reservoir. These recovery statistics can be used for reservoir screening, characterization, and economic analysis. The most representative or "median recovery" well will also be identified.

Also included will be cumulative oil and gas pro-

duction and the most recent year of annual production. (The full historical annual production data series is considered proprietary to licensees of Dwight's data and will not be included on the CD-ROM). Reserve-to-production (R/P) ratios will be used to estimate remaining gas reserves and ultimate recovery for each reservoir. R/P ratios will be determined from state and district level EIA production and reserve data.

Original gas-in-place (OGIP) information is sparsely covered in both public and commercial reservoir databases, and where present, has generally been taken from published sources. Published estimates of OGIP or ultimate recovery have limited value because they are generally dated and the methodology is unknown or undocumented. Despite this, GASIS will include OGIP where it has been published by the atlas project or is present in Dwight's database. Development of new estimates of OGIP using historical pressure and production data is not a part of the current GASIS project.

Wellhead gas composition will be reported by component, including C<sub>1</sub> through C<sub>6</sub>-plus, nitrogen, carbon dioxide, and H<sub>2</sub>S, and will be derived from the GRI database developed by EEA using Bureau of Mines and other data.

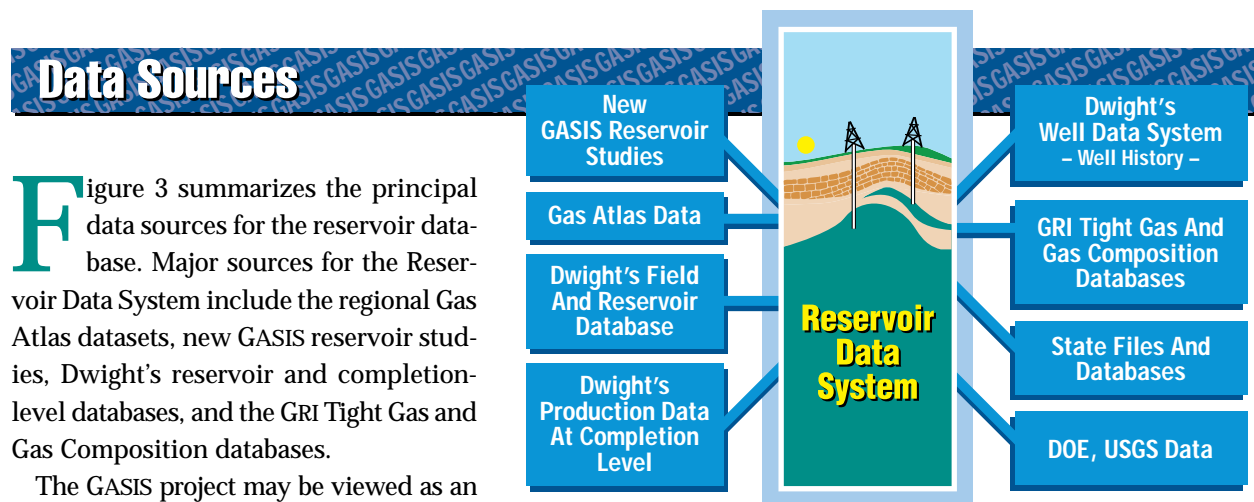


Figure 3. Data Sources For Reservoir Data System

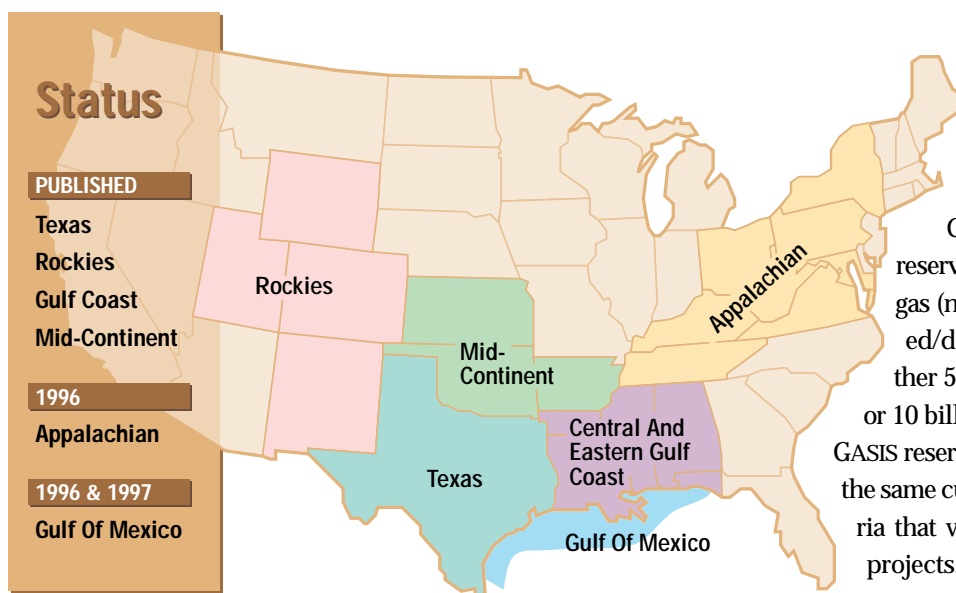


Figure 4. GRI/DOE Regional Gas Atlas Projects

voir data. Figure 4 shows the Gas Atlas project areas and Figure 5 summarizes the play and reservoir coverage of each project. (Counts for the Appalachian and Gulf of Mexico atlases are preliminary).

A major contribution of the Gas Atlas project is the definition and geological description of exploration plays in each region and the assignment of reservoirs to these plays. This work has resulted in the first public domain play classification system for the U.S. Play description and classification is valuable because reservoirs within a specific play often display many similar geological and engineering characteristics. This allows a modeler or explorationist to make generalizations about play attributes. In addition,

the discovery history of exploratory plays provides insight into future potential.

The published onshore Gas Atlas databases include reservoirs with cumulative total gas (nonassociated plus associated/dissolved) production of either 5 billion cubic feet (Rockies) or 10 billion cubic feet (other areas). GASIS reservoirs will be selected using the same cumulative production criteria that were used in the Gas Atlas projects, although GASIS will use more recent production data than most of the atlases. (The final release

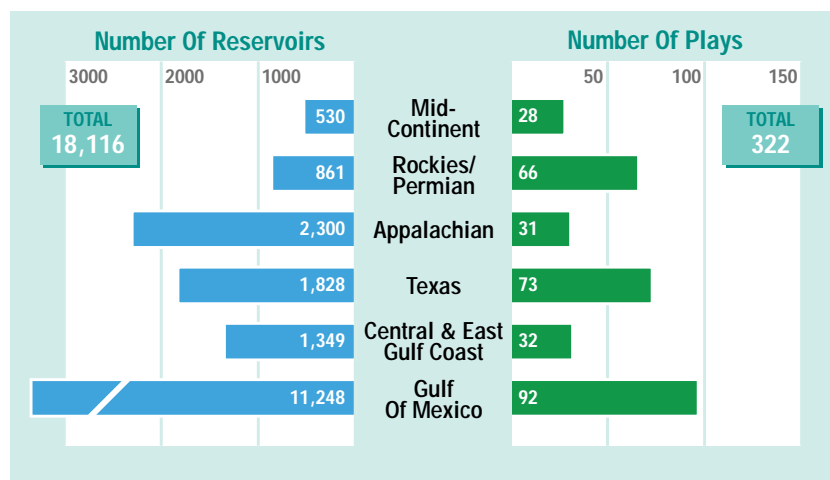
will have data through 1996). In areas where no production criteria are used to select atlas reservoirs, GASIS will include the reservoirs selected for the atlas. All producing regions that are covered by the Gas Atlas project will be included on the CD-ROM. Excluded areas are the Michigan/Illinois Basins, onshore and offshore California, Montana, North Dakota and Alaska.

Dwight's has made available a large amount of geological and engineering information for GASIS. Dwight's PDS (Petroleum Data System) "TOTL" field and reservoir file is the primary source of data. This information has been assembled from numerous sources including industry compilations, state and federal agencies, and specific reservoir studies. The Dwight's Oil and Gas Reports (DOGR) database contains gas production and pressure

data at the individual well completion level. This database will be used to calculate productive gas area (number of sections) and average gas well spacing. Periodic pressure data in this database can also be used to estimate current reservoir pressure.

The GRI Gas Composition and Tight Gas databases will also be incorporated into GASIS. The primary data source for the Gas Composition database was the U.S. Bureau of Mines gas sample

Figure 5. Scope Of GRI/DOE Gas Atlas Projects



database, which contains composition data for gas samples from over 15,000 wells. The GRI Tight Gas Database identifies all of the reservoirs in non-Appa-

lachian areas that fall within the Federal Energy Regulatory Commission-designated tight gas formation areas.

## Reservoir Studies

A major reservoir study effort is underway to improve the coverage and quality of geological, engineering, and production data in gas producing areas. Figure 6 shows that over 550 studies have been completed through 1995 in the Mid-Continent, East Texas, Central and Eastern Gulf Coast, and Rocky Mountain atlas regions. Several hundred

**Figure 6. Completed GASIS Reservoir Studies**

— Through 1995 —

		Number Of Studies
Mid-Continent	Anadarko Basin	170
	Arkoma Basin, Chautauqua Platform	44
Texas	Texas Panhandle	67
	East Texas Basin	102
Eastern Gulf Coast	North Louisiana	39
	Mississippi, Alabama, Florida	98
Rockies	Green River Basin	33
Total		553

more studies are planned, with an initial emphasis in 1996 on continued work on major gas plays in the Rockies. No studies are currently planned for the Texas Gulf Coast, South Louisiana, Gulf of Mexico, or Appalachian regions.

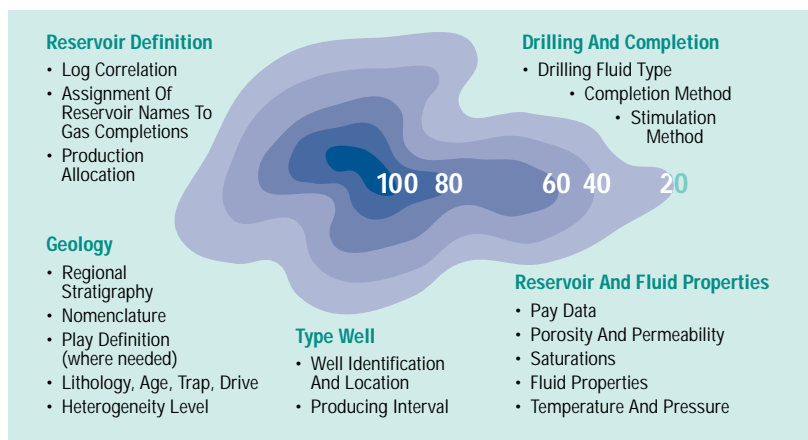
As summarized in Figure 7, a large dataset of geological and engineering information is being collected for each reservoir. Parameters include net pay, porosity, permeability, initial pressure, and gas and fluid properties. In addition to reservoir averages, an observed range of values is also reported for major parameters. As mentioned previously, a geological “type well” for each reservoir is also being selected.

A primary consideration for the reservoir study effort is to correct

“reservoir definition” problems in key areas. Reservoir definition is the identification of the completions that produce from a reservoir, and was a problem in the Mid-Continent and other areas. In some states, reservoir level production data are not reported by the regulatory agency. To create a reservoir level production database in these areas, it is necessary to sum well level production within each reservoir using the reservoir name information. In many cases the reservoir name on the well record is either missing or inadequate to correctly define a reservoir. Reservoir definition problems can be dealt with only through detailed log correlation and production database modification.

The GASIS Mid-Continent reservoir study effort included 214 studies in the Anadarko and Arkoma Basins, and emphasized reservoir definition for the “problem” stratigraphic intervals of Pennsylvanian age which represent a large fraction of gas production in the region. Figure 8 shows the boundaries of the principal Gas Atlas plays that were studied in the Anadarko Basin of Oklahoma and the Texas Panhandle. The quality of the GASIS database in the Mid-Continent is much better than what was publicly available before the project started. This work is

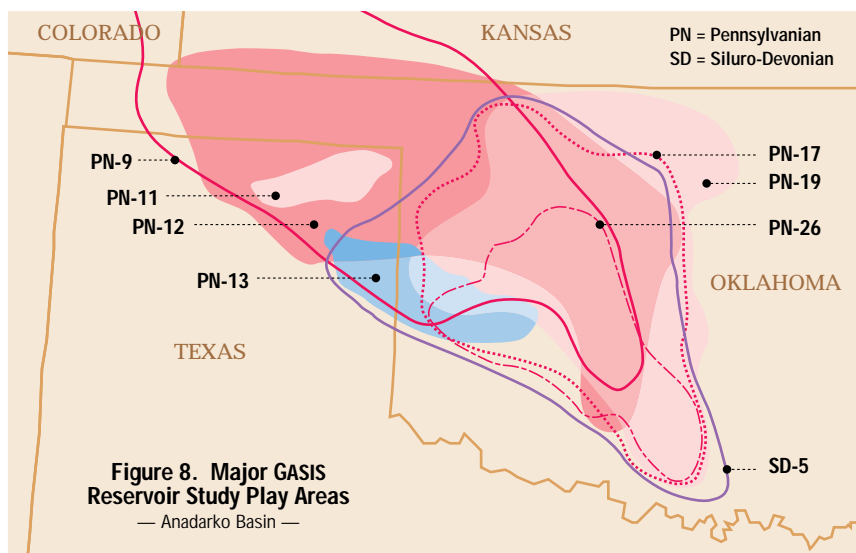
**Figure 7. Scope Of GASIS Reservoir Studies**





expected to greatly improve the ability of operators in the region to make critical exploration, development, and investment decisions.

In addition to reservoir definition work, a significant portion of the reservoir study effort is being directed toward analysis of low permeability gas plays and reservoirs. Improvement of the coverage and quality of tight gas reservoir data will allow DOE to more effectively prioritize their research in this area.



## GASIS Software

The GASIS CD-ROM will include Windows-based software for manipulation of the reservoir database and Source Directory information. The software is being developed using the Foxpro commercial software development package. The initial phase of GASIS software development has been completed and is included with the current "prototype." The prototype contains the preliminary reservoir database and Source Directory and the software for query and retrieval. All onshore atlas areas are included except the Appalachian Basin. Most of the GASIS data elements are populated in the prototype, with the exception of gas composition, tight gas flags, and recovery statistics.

The software contains query and retrieval, display, report, and data export functions. Basic queries by state, basin, or field name are facilitated by scrolling selection lists. A detailed query screen allows record selection on the basis of any data field. An example of a detailed query screen is shown in Figure 9. The entire list of data elements is included in a scrolling selection list. Logical operators can be applied to any numeric data element or combinations of elements. (An example would be "all

DATA ELEMENT	OPERATOR	VALUE
1 AAPG basin name	In	GREEN RIVER
2 tight gas	Equal To	Y
3	Equal To	
4	Equal To	
5	Equal To	

Figure 9. Sample Query Screen For Data Elements

reservoirs in the Green River Basin with depths greater than 10,000 feet and porosities greater than 10 percent). Data can be displayed on the screen in either a single record format or "browse" mode with one row

for each record. Datasets can be exported in standard formats for manipulation with other software packages. Export format options will include ASCII, Lotus, and dBASE. A project is also underway to add basic graphical capabilities to GASIS. This software will allow the user to generate crossplots and histograms of any numeric reservoir data.

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